12 – Southeast Indiana
Exceptional Events Detail

Parameter: $PM_{2.5}$

Dates: May 24 – June 2, 2007

Location: Jeffersonville / New Albany – Clark / Floyd Co.

Event: Smoke from wildfires in northern Florida and southern Georgia impacted the Jeffersonville / New Albany region during the period of May 24 – June 2. The gradual buildup of smoke moving through the area during this period resulted in exceedances of the 24-hour $PM_{2.5}$ NAAQS on May 29th at Jeffersonville (18-019-0006) and June 2nd at both Jeffersonville and New Albany (18-043-1004). Elevated values were reported on all other days, as well.

Data: Different analyses of the data are used to demonstrate that the $PM_{2.5}$ concentrations measured from May 24 – June 2 are beyond the range of values typically found during that time period and that they have been influenced by outside events. Table 12.1 shows daily $PM_{2.5}$ averages prior to, during and after the event with the values flagged in **bold**. Data have been flagged with an exceptional event flag of 'E' in AQS, awaiting concurrence from EPA.

Tables 12.2 and 12.3 list summaries of the data collected at the two sites since 2000. Data from 2007 are calculated with all current data and with the flagged data removed. There is an improvement in the status of the area as the Daily Design Value for the Jeffersonville 2005-2007 time period goes from 40 to 39.

The values recorded during the May 24 – June 2 time period are outside the normal values collected during the month of May. Prior to this time, the highest value reported in May at New Albany had been 26.5 ug/m3 and the highest May average had been 15.96 ug/m3. With the high data collected in May 2007, the highest value was 29.7 ug/m3 (35.4 on June 2) and the monthly average was 20.52 ug/m3. Removing the flagged data results in a maximum daily concentration of 28.8 ug/m3 and an average concentration of 17.39 ug/m3.

The highest value reported in May at Jeffersonville since 2000 had been 30.7 ug/m3 and the highest monthly average was 17.24 ug/m3. With the high data collected in May 2007, the highest value was 38.2 ug/m3 (40.2 on June 2) and the monthly average was 21.9 ug/m3. Removing the flagged data results in a daily maximum of 30.7 ug/m3 and an average concentration of 18.06 ug/m3.

At both sites, these values are much more in line with historical data. The summary data from the past months of May are in Table 12.4.

Table 12.1 - FRM Daily Values Exceptional Event Period

Values in **BOLD** are flagged as exceptional events

Date	Jeffersonville 18-019-0006	New Albany 18-043-1004
5/17/07	8.5	
5/18/07	7.5	4.5
5/19/07	15.7	
5/20/07	18	
5/21/07	24.3	18
5/22/07	25.5	
5/23/07	IN	
5/24/07	**32**	**29.7**
5/25/07	**32.8**	
5/26/07	**32.6**	
5/27/07	**28.9**	**25.4**
5/28/07	**33.8**	
5/29/07	**38.2**	
5/30/07	**29.2**	**28.4**
5/31/07	**33.4**	
6/1/07	**32.3**	
6/2/07	**40.2**	**35.1**
6/3/07	23.3	

Table 12.2 - Historical Daily Values

		Jeffersonville 181090005 & 6		New Albany 180431004	
Year		98th %ile	Daily Design Value[1]	98th %ile	Daily Design Value[1]
2000		41.3		36.5	
2001		41.7		38.2	
2002	2000-2002	46.1	43	40.8	39
2003	2001-2003	40.4	40	33.9	38
2004	2002-2004	28.4	34	26.7	34
2005	2003-2005	45.5	38	40.1	34
2006	2004-2006	35.9	37	28.2	32
2007	2005-2007	38.1	40	35.4	35
		Values excluding flagged data			
2007	2005-2007	37	39	35.4	35

[1]Daily Design Value = 3 year average of annual 98th %ile values.

Table 12.3 - Historical Annual Averages

Year		Jeffersonville 181090005 & 6		New Albany 180431004	
		Annual Ave.	Annual Design Value[2]	Annual Ave.	Annual Design Value[2]
2000		18.6		16.3	
2001		16.9		15.7	
2002	2000-2002	16	17.2	14.6	15.5
2003	2001-2003	16.9	19.1	14.4	14.9
2004	2002-2004	15.1	17.1	13.7	14.2
2005	2003-2005	18.5	17.6	16.8	15
2006	2004-2006	15	16.2	13.3	14.6
2007	2005-2007	16.5	16.7	14.7	14.9
		Values excluding flagged data			
2007	2005-2007	16	16.5	14.1	14.8

[2]Annual Design value = 3 year average of the annual averages.

Table 12.4 – Examination of Daily Maximums and Averages for May Monitored Values for 2000-2007

Year	Maximum Values		Monthly Averages	
	Jeffersonville	New Albany	Jeffersonville	New Albany
2000	25.7	21.2	17.24	15.96
2001	30.1	25.3	16.32	15.71
2002	21.2	21.2	14.78	14.05
2003	18.7	16.1	11.52	10.76
2004	22	21.9	14.1	13.27
2005	25.3	24.9	16.07	14.59
2006	22.5	26.5	11.6	10.39
2007	38.2	29.7	21.94	20.52
Values with flagged data removed				
2007	30.7	28.8	18.06	17.39

Particulate Composition: Speciation data are collected at the Southwick (21-111-0043) monitoring site in Louisville on a one in six day sampling schedule. Data are available for May 24 and May 30. High organic carbon values were reported on those two dates; 7.28 ug/m3 and 7.92 ug/m3 respectively. These values are in line with the high organic carbon values reported, in the 7 to 11 ug/m3, across the Midwest on these days. The high organic carbon values, without an increase in elemental carbon, are a very good indicator of biomass combustion.

The maps in Appendix 3 shows the rise and fall of the organic carbon values across the region over this time period.

Maps: Images of maps from NOAA Satellite and Information Services show the smoke plume originating from the northern Florida/southern Georgia region. Dispersion and movement of the smoke plume from these fires was generally to the west or northwest and then to the north. The daily satellite smoke photos show that the smoke plume from the fires comes into southern Indiana on May 23 and continues to influence the atmosphere until June 2. . The daily wind roses show information on prevailing wind direction, calm conditions and wind speed. (Note: Met data are from industrial site 180430004. Data were input into the State database to obtain the wind rose processed under the Charlestown site name.) NOAA weather maps are also used to show that an upper level trough greatly influences the direction of the plume in relation to the Jeffersonville / New Albany area.

Trajectory Modeling: The NOAA HYSPLIT Models are used to show wind trajectories at different levels during this event. Backward modeling from the Jeffersonville site (latitude: 38.28°; longitude: -85.74°) at elevations of 25m, 150m and 500m was conducted for a period of three (3) to four (4) days prior. The differing elevations were chosen to demonstrate the air mass's uniformity at ground-level where the samplers were located and aloft which avoids the ground-level limitations of the model. Forward modeling, Appendix 2, was conducted using the Bugaboo Scrub Fire as the starting point (latitude: 30.70°; longitude: -82.40°) at an elevation of 250 meters (appropriate height that is low enough to always be in the well-mixed zone and high enough to avoid the ground-level model limitation) and going three (3) to four (4) days. Overall, there is a very good correlation when comparing the forward and backward trajectories for a given date. For example, May 26 and 30 show a very narrow channel of air flow between southeastern Georgia and southeastern Indiana. Both the backward and forward trajectories confirm this. Forward trajectory modeling can be found in Appendix 2.

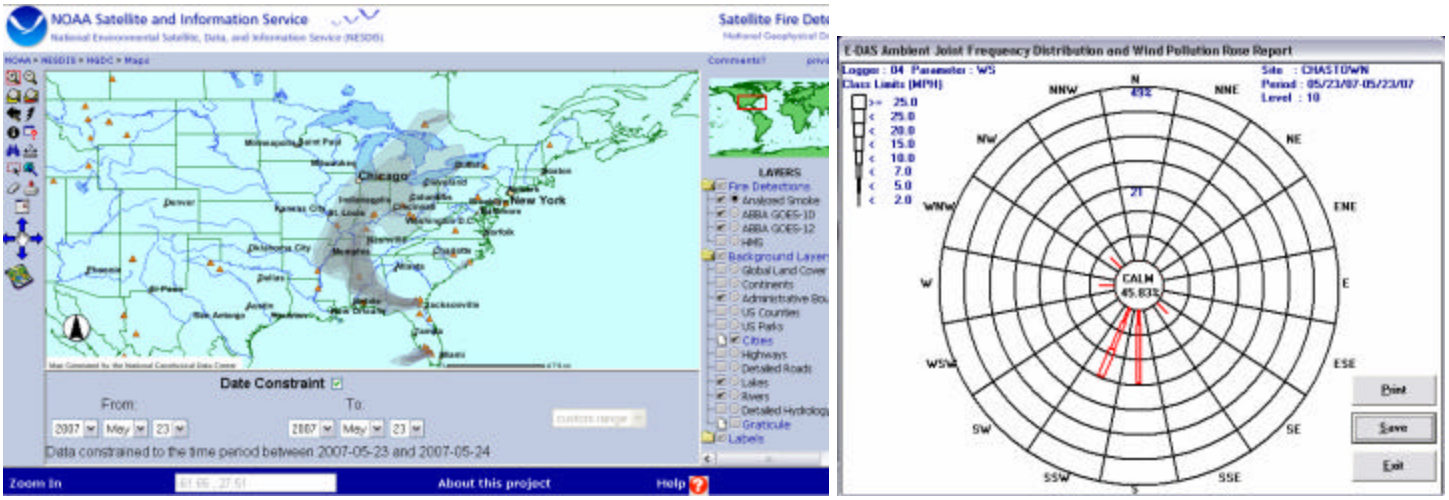
Conclusion: EPA defines an "exceptional event" as an unusual or naturally occurring event that can affect air quality but is not reasonably controllable by state and local agencies. Exceptional events are events for which the normal planning and regulatory process established by the clean air act is not appropriate. Indiana has illustrated through the use of maps, meteorological data, speciation data, trajectory models and historical data that the smoke

from wildfires in Florida and Georgia impacted the Jeffersonville / New Albany region during the period of May 24 – June 2, 2007 causing exceedances of the $PM_{2.5}$ 24-hour standard and significantly increasing the annual average. When removing the data from this time period, the Daily Design Values at Jeffersonville for the 2005-2007 period drop from 40 to 39 ug/m3. According to 40 CFR Part 50.14 (b)(1), "EPA shall exclude data from use in determinations of exceedances and NAAQS violations where a State demonstrates to EPA's satisfaction that an exceptional event caused a specific air pollution concentration in excess of one or more national ambient air quality standards at a particular air quality monitoring location and otherwise satisfies the requirements of this section." IDEM believes they have successfully illustrated the impact of this event on the sites in this region.

Therefore, IDEM requests that EPA concur with the 'E' flag on the data in AQS for the data in **bold** in Table 1.

NOAA Satellite Smoke Maps, Weather Maps, and Wind Roses

The smoke map shows that the plume has reached the Jeffersonville / New Albany area and as shown in Table 12.1, $PM_{2.5}$ levels have started to increase. The corresponding wind rose and weather map further illustrate the direction of the plume by the location of the upper level trough (orange dashed line) and the S, SSW prevailing winds.



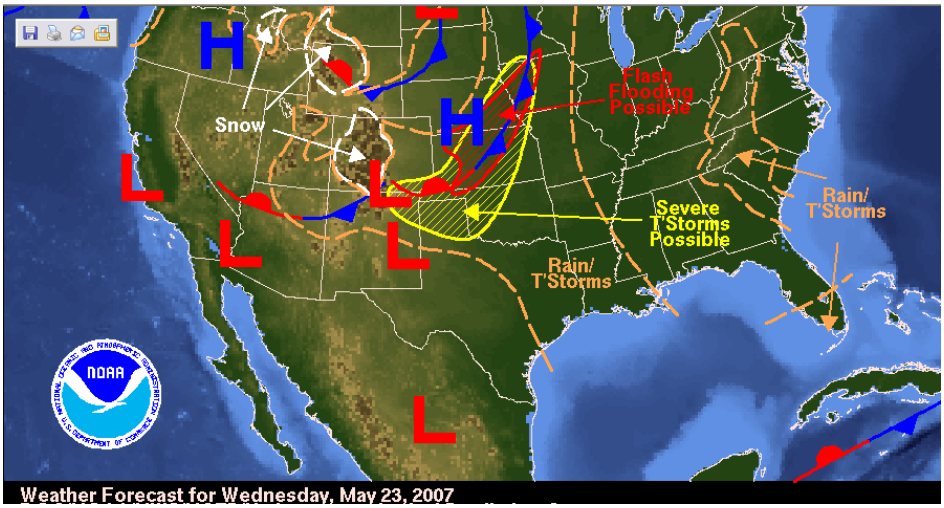
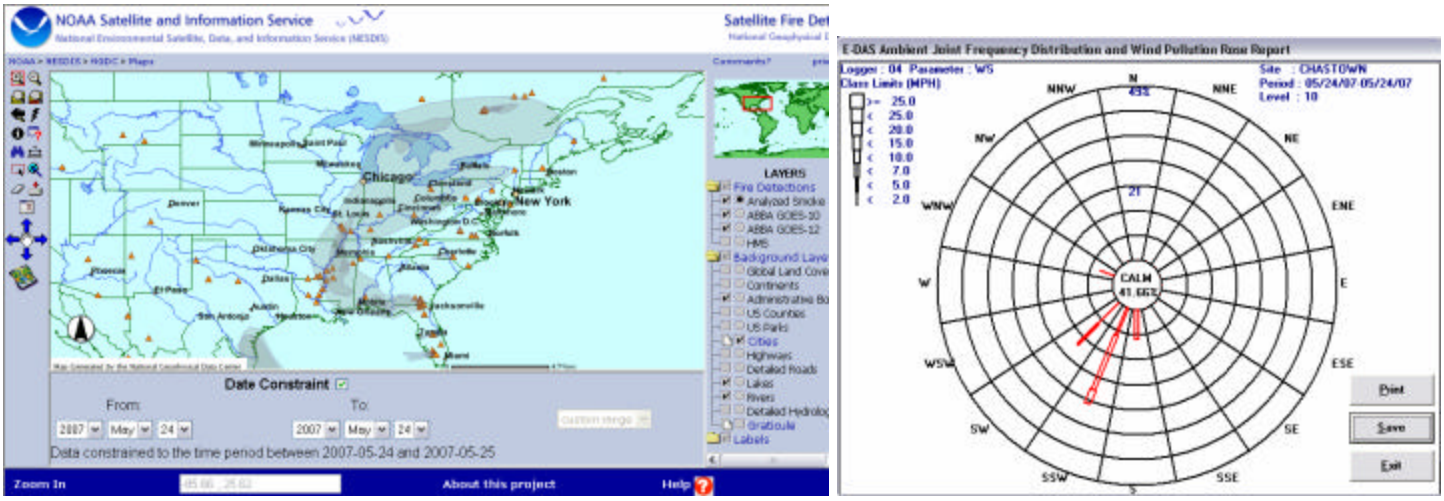


Figure 12.1 - May 23, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction has shifted to the SSW as the upper level trough moves further to the east and another trough develops over Ohio, keeping the plume over the SE Indiana region.



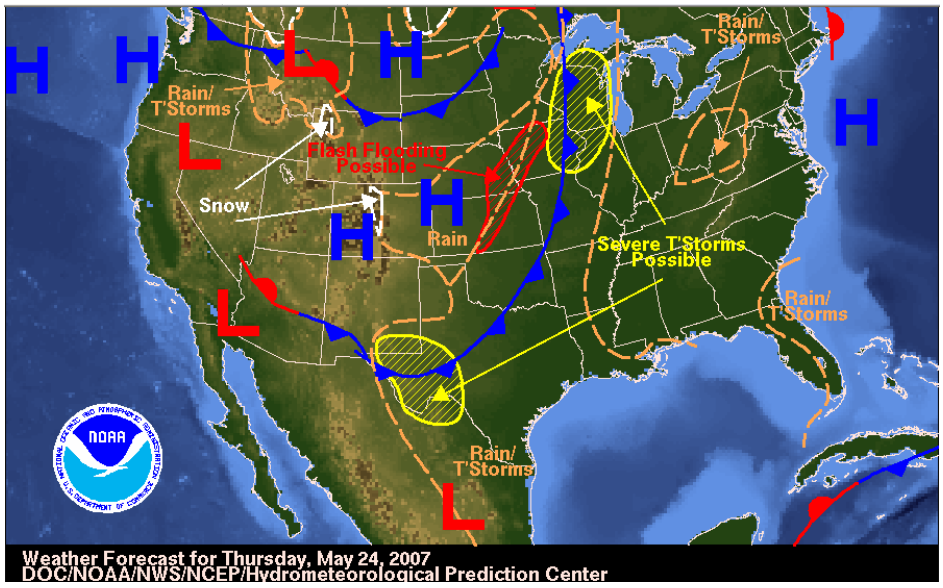


Figure 12.2 - May 24, 2007

The smoke map shows that the plume is remaining over the area. The prevailing wind direction continues to be from the south as the upper level trough has now moved directly over the SE Indiana region.

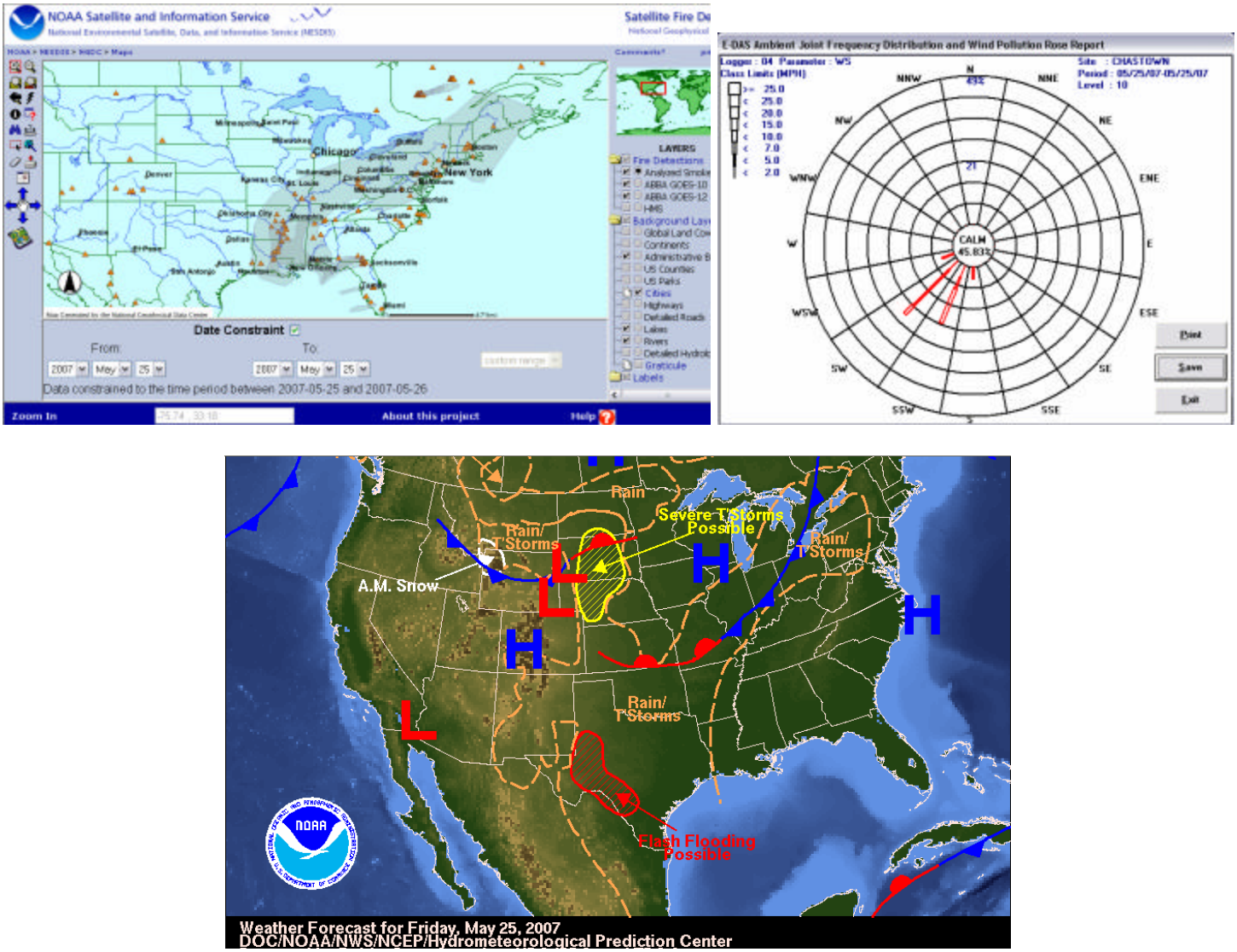


Figure 12.3 - May 25, 2007

The smoke map illustrates that the plume has essentially dissipated as the trough keeps the smoke pushed to the south. However, due to the prevailing calm wind conditions the stagnant air mass continues to cause the $PM_{2.5}$ levels to rise past the 24-hour standard.

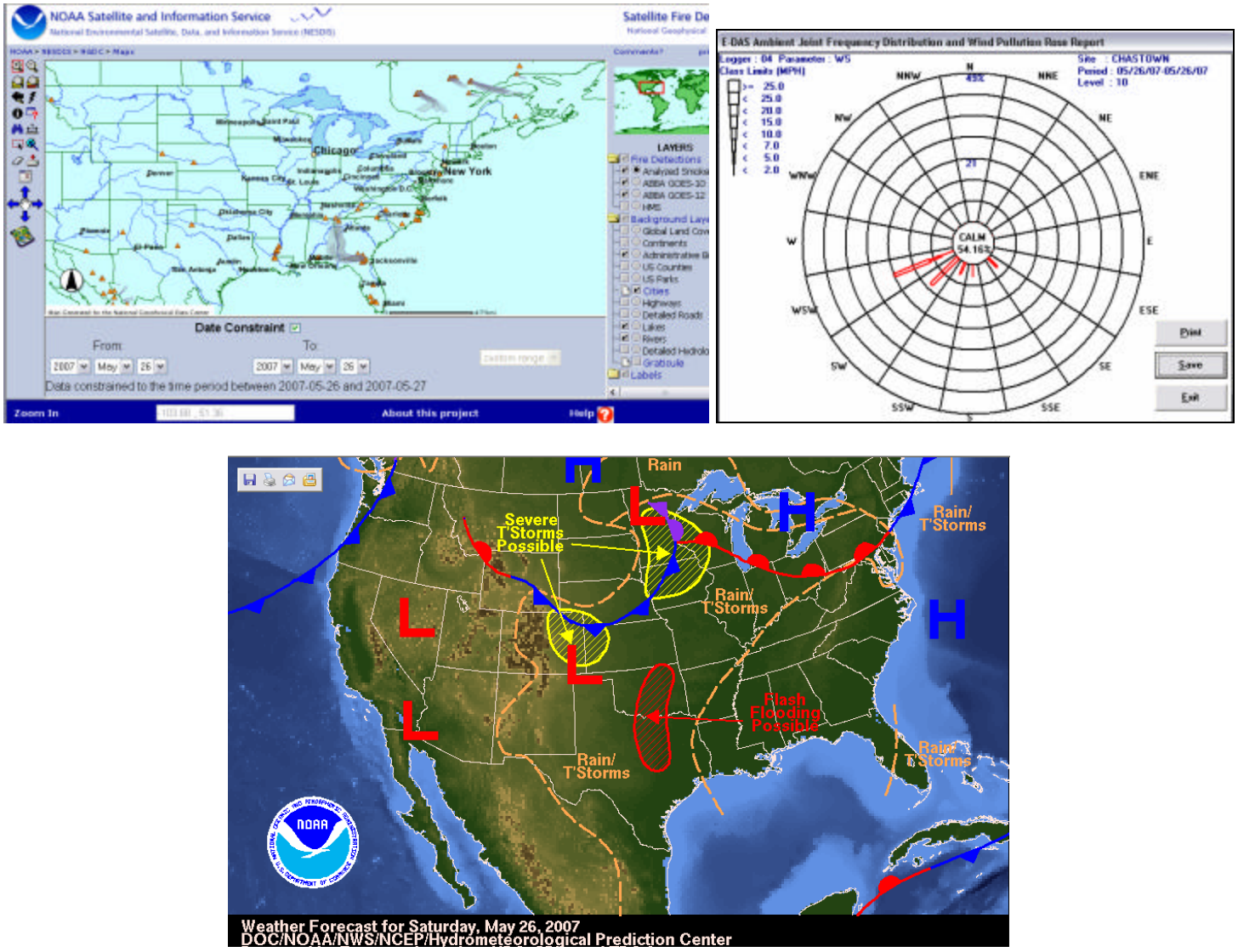
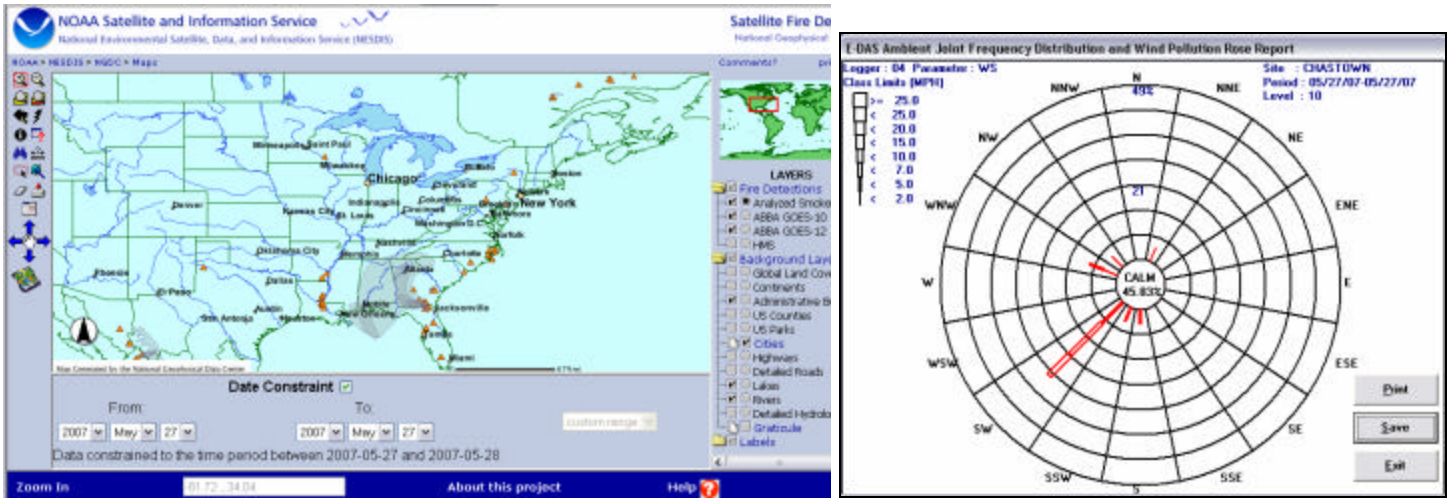


Figure 12.4 - May 26, 2007

The smoke map illustrates that the plume continues to stall as the trough continues to keep the smoke pushed to the south. However, due to the predominately calm wind conditions the stagnant air mass continues to cause the $PM_{2.5}$ levels to remain elevated.



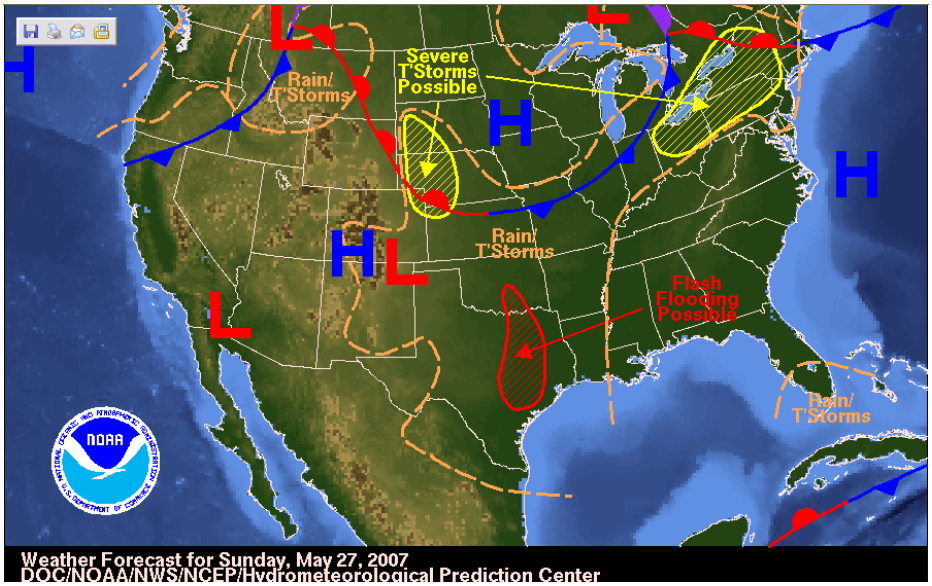


Figure 12.5 - May 27, 2007

The smoke map shows the plume has been pushed back into the region due to the upper level trough moving to the north and causing the plume to become more concentrated over the area.

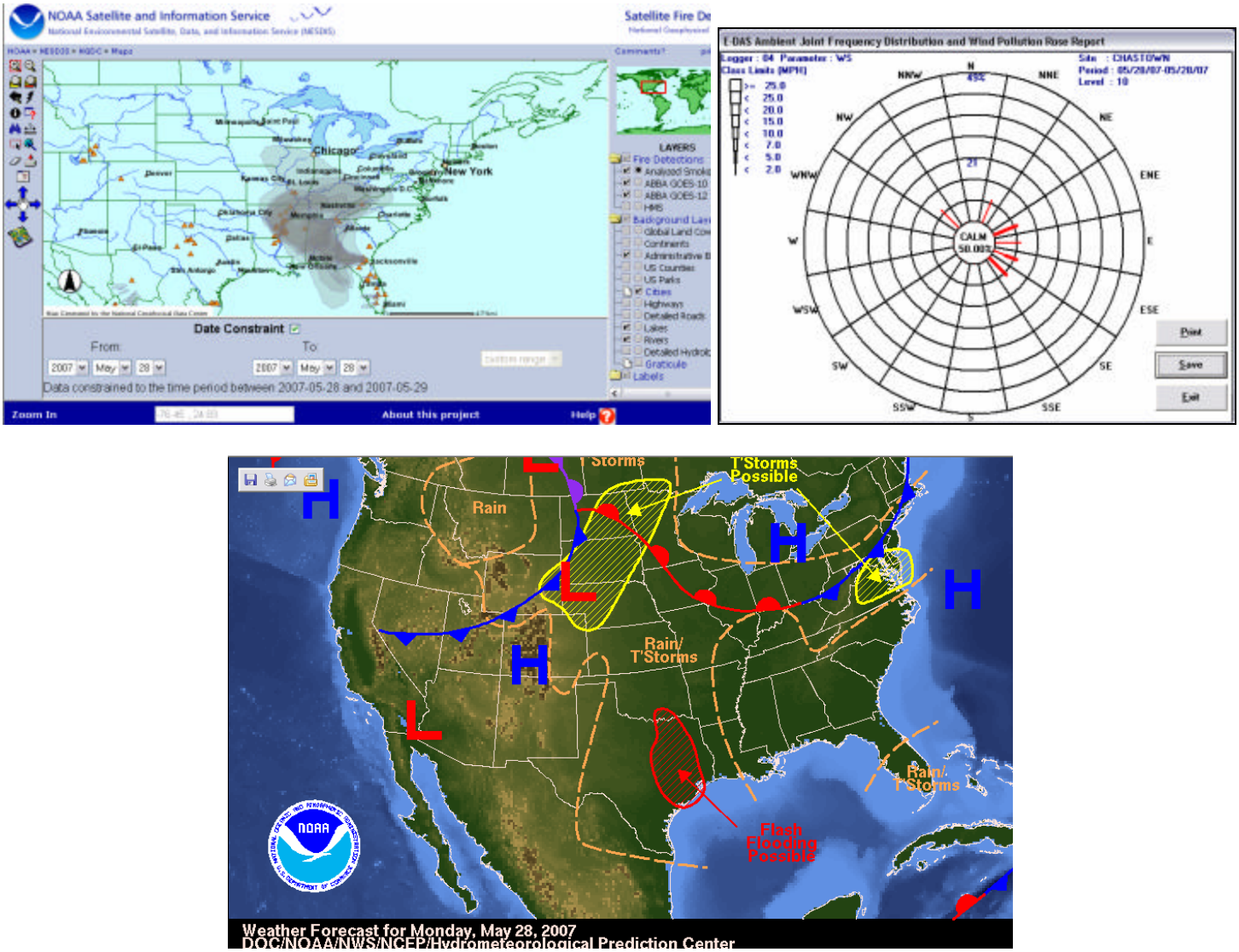


Figure 12.6 - May 28, 2007

Although the map illustrates the plume is not over the region, the prevailing SE wind direction, as shown by the wind rose, keep the high levels of $PM_{2.5}$ over the area.

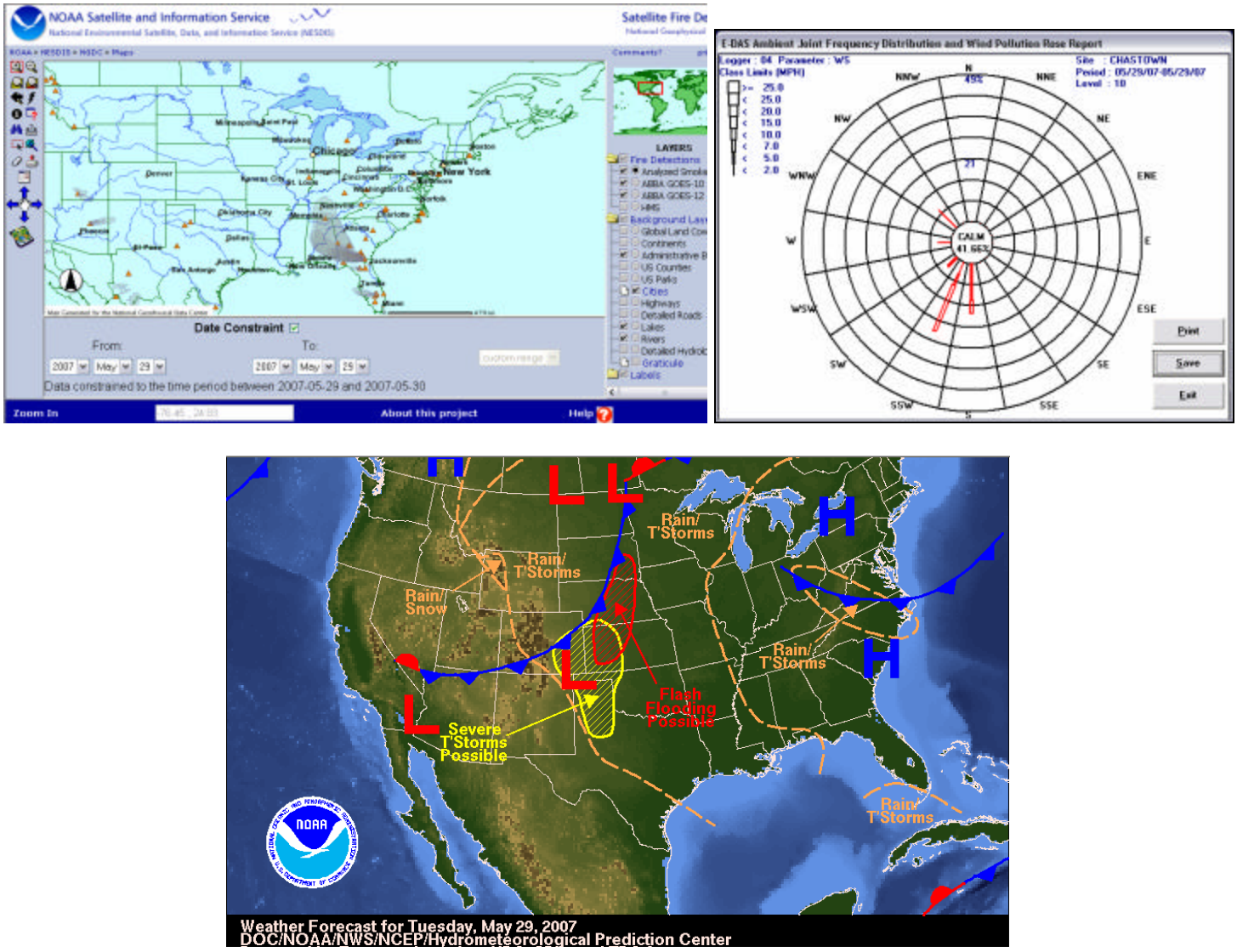
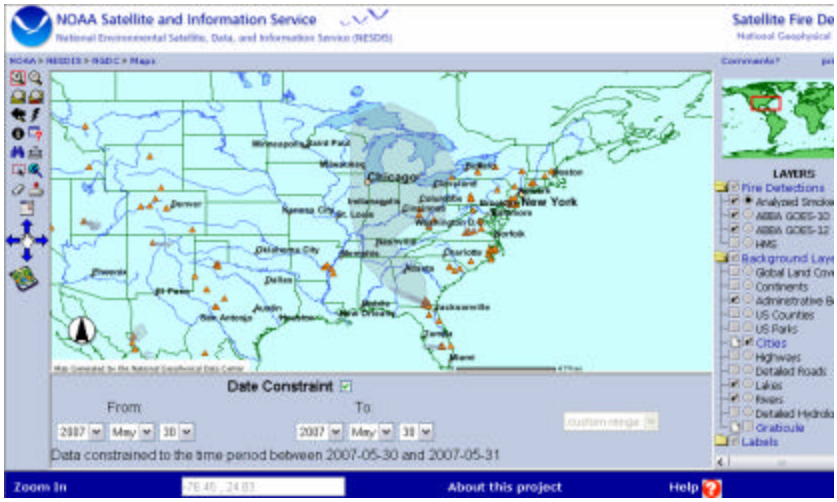
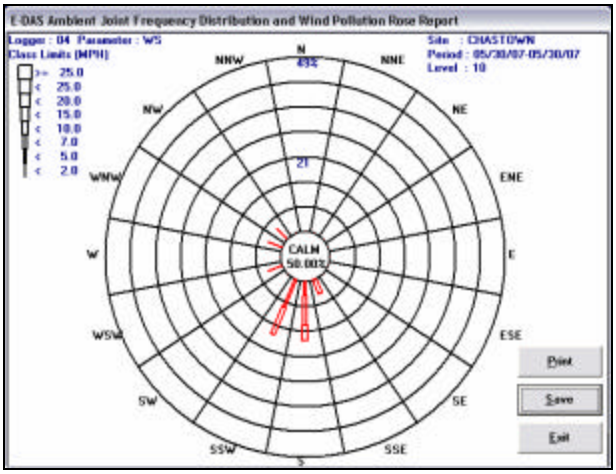


Figure 12.7 - May 29, 2007

The map shows the plume has moved back over the region as the upper level trough dips down over the area and the wind direction continues to be from the S, SW.





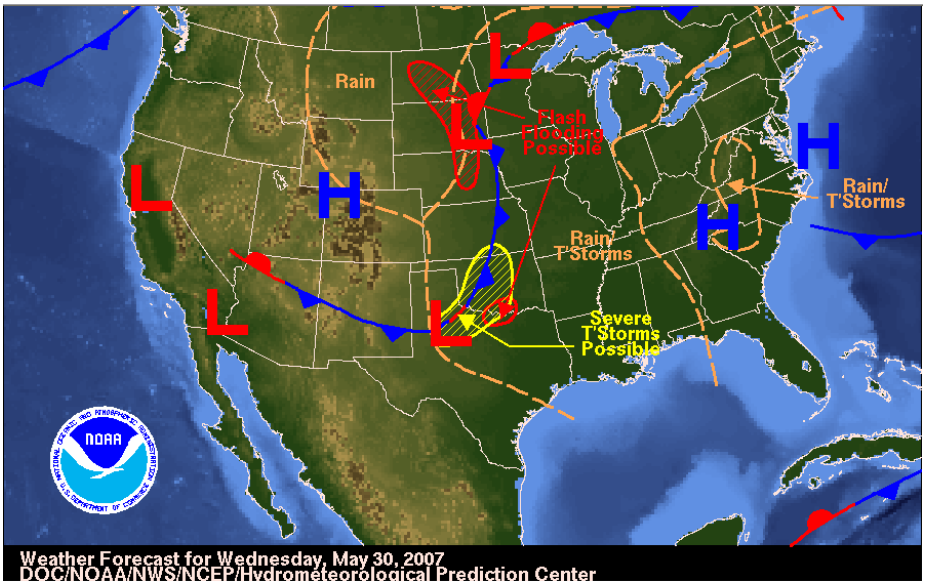


Figure 12.8 - May 30, 2007

The map shows the plume has dissipated as the upper level trough and increased wind speed have pushed the remaining smoke toward the east and out of the region. However, due to the prevailing calm wind conditions, high levels of particulate remain.

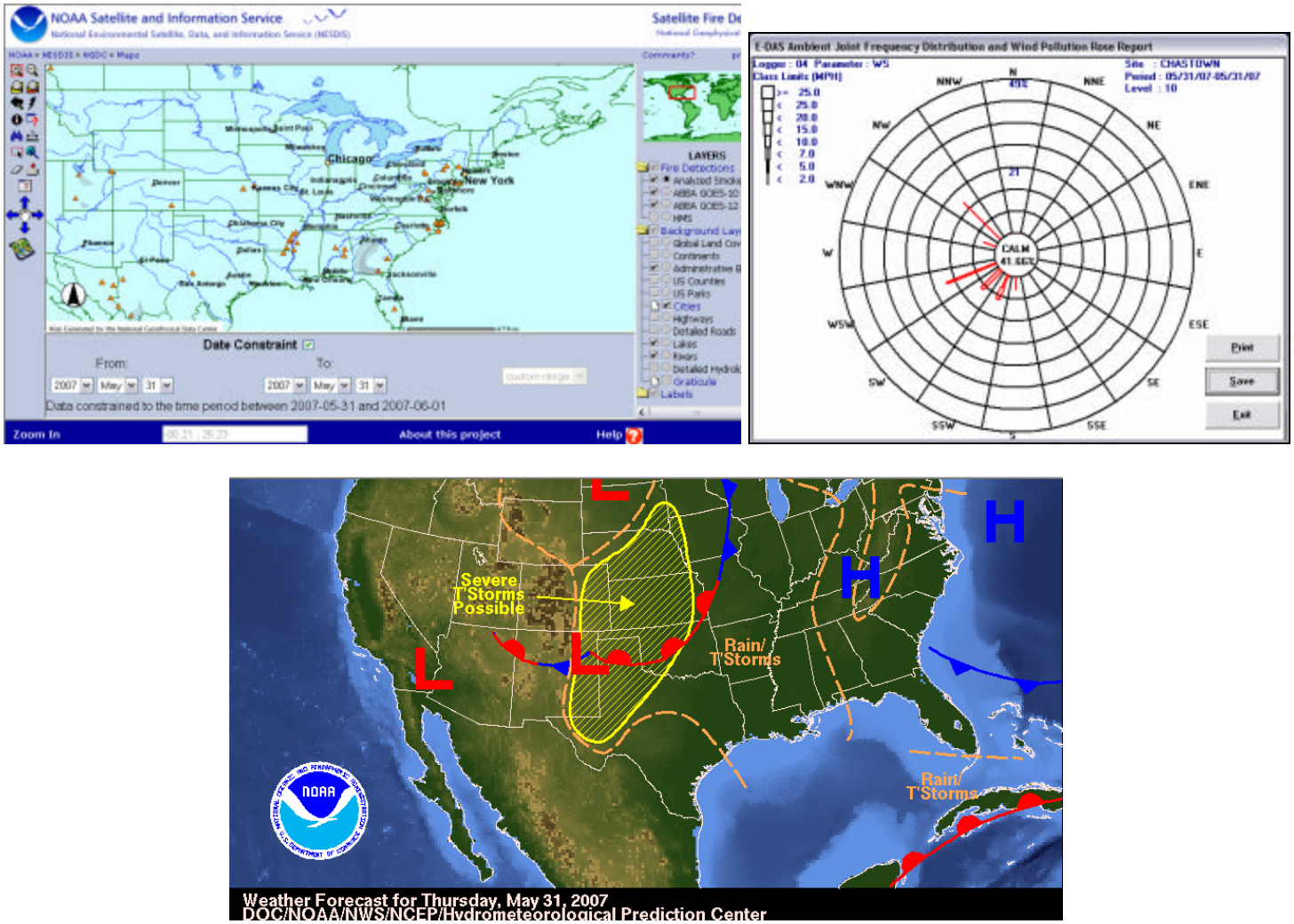


Figure 12.9 - May 31, 2007

The smoke map shows the plume has been pushed out of the region but due to the calm weather conditions, high levels of particulate remain.

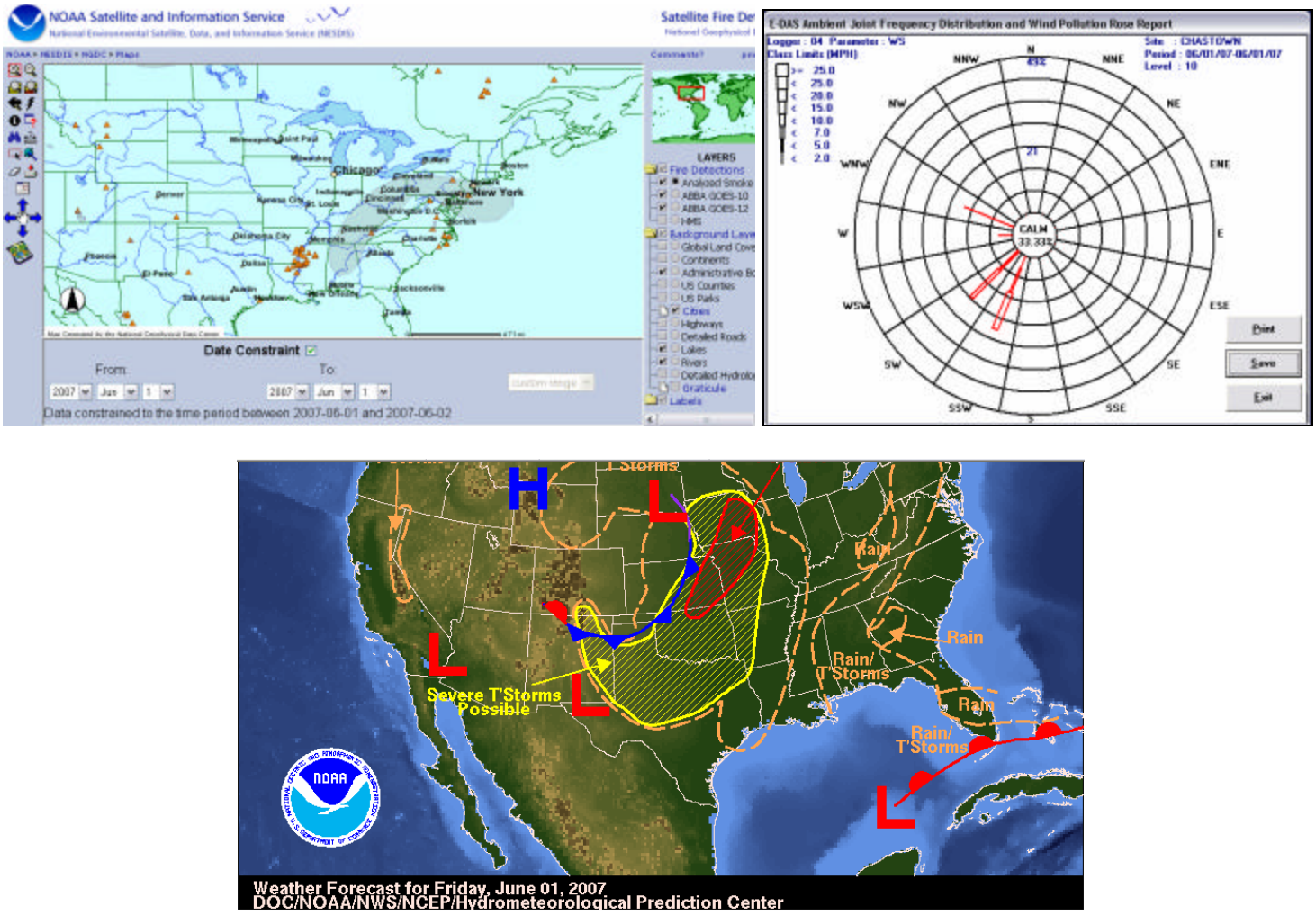


Figure 12.10 - June 1, 2007

The smoke map shows the plume has dissipated over the region but due to the calm weather conditions and a local fire, high levels of particulate remain.

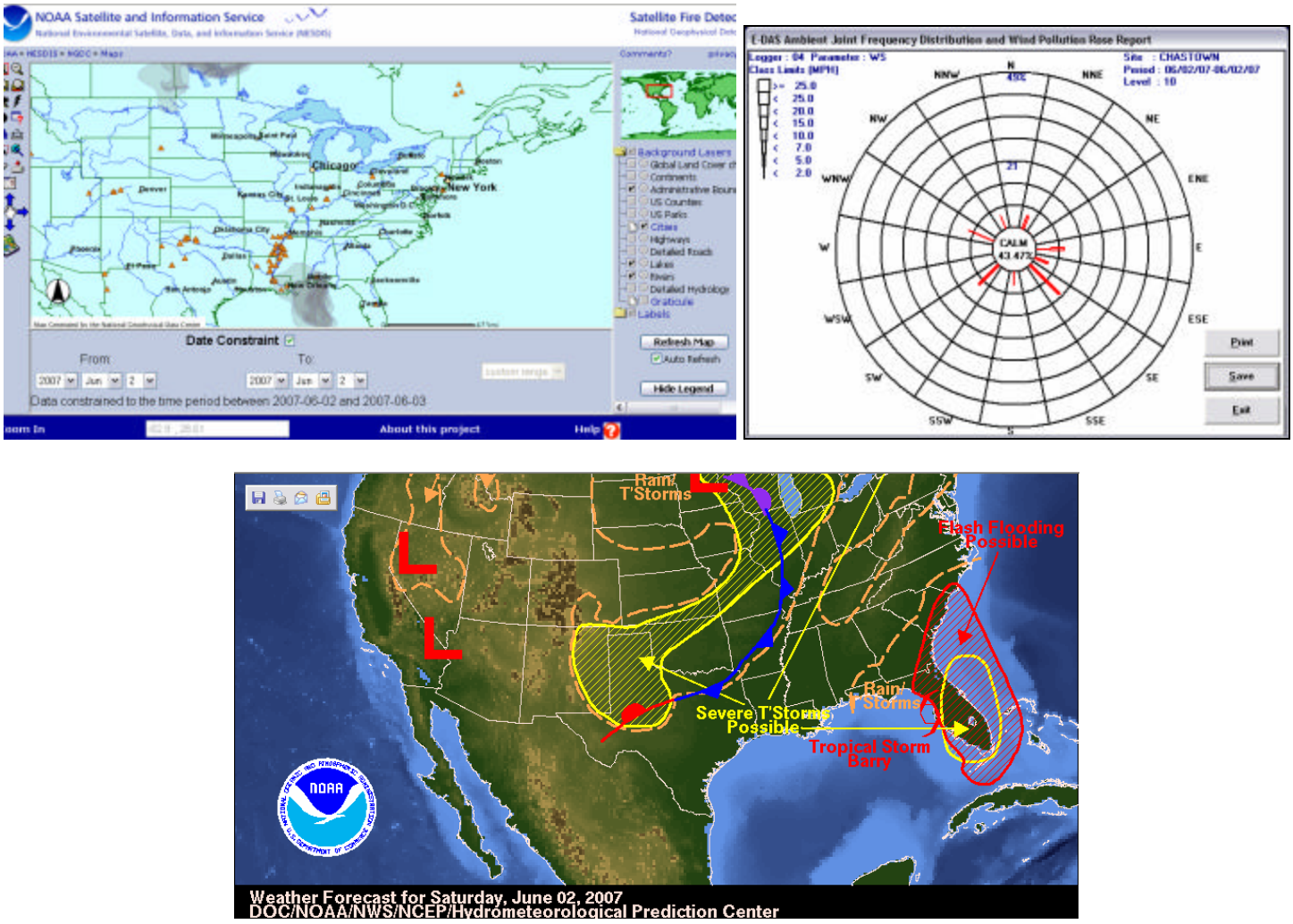


Figure 12.11 - June 2, 2007

Back Trajectory Modeling

NOAA ARL READY HYSPLIT Maps

Draxler, R.R. and Rolph, G.D., 2003. HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (http://www.arl.noaa.gov/ready/hysplit4.html). NOAA Air Resources Laboratory, Silver Spring, MD.

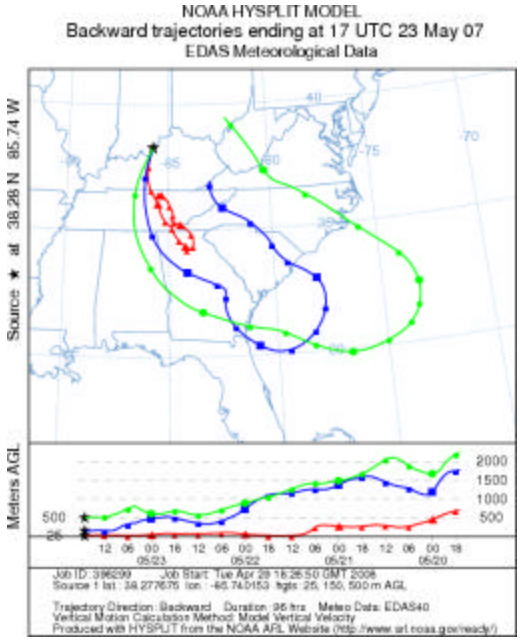


Figure 12.12: Backward trajectories originating from Jeffersonville on 5/23/07 at 12:00 PM EST showing the air mass passing over southern Georgia.

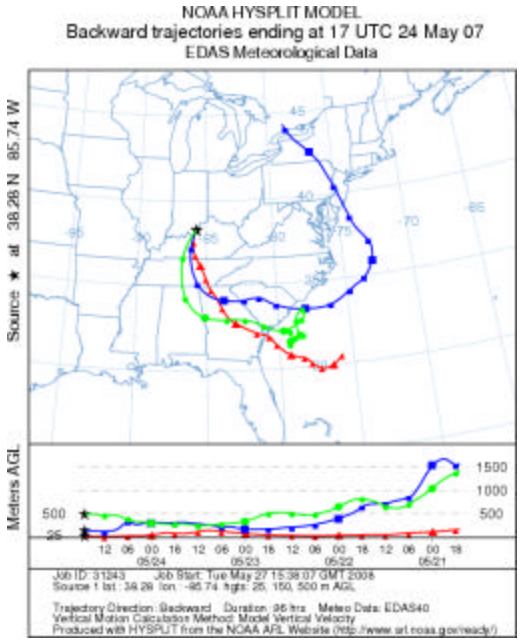


Figure 12.13: Backward trajectories originating from Jeffersonville on 5/24/07 at 12:00 PM EST showing continuation of the air mass passing over Georgia.

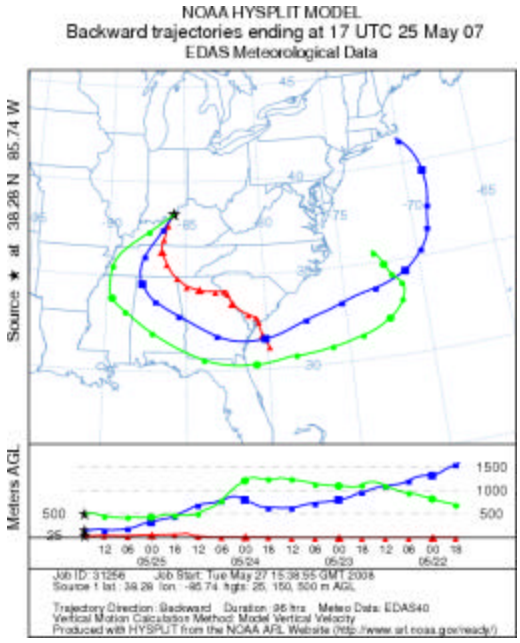


Figure 12.14: Backward trajectories originating from Jeffersonville on 5/25/07 at 12:00 PM EST showing the air mass still passing over southern Georgia and northern Florida.

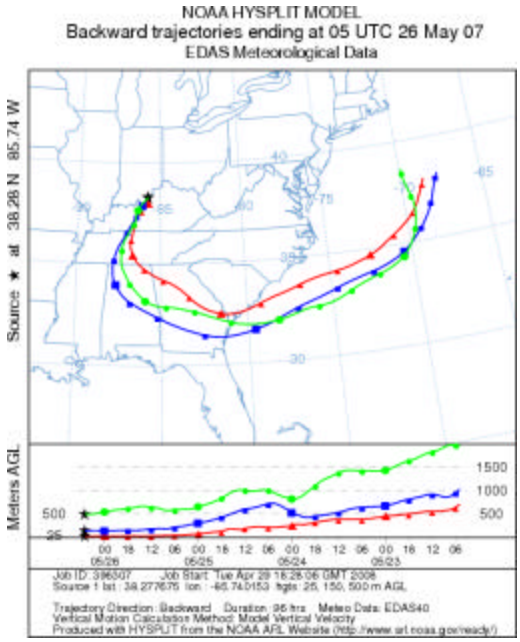


Figure 12.15: Backward trajectories originating from Jeffersonville on 5/26/07 at 12:00 AM EST showing continuation of the air mass passing over Georgia.

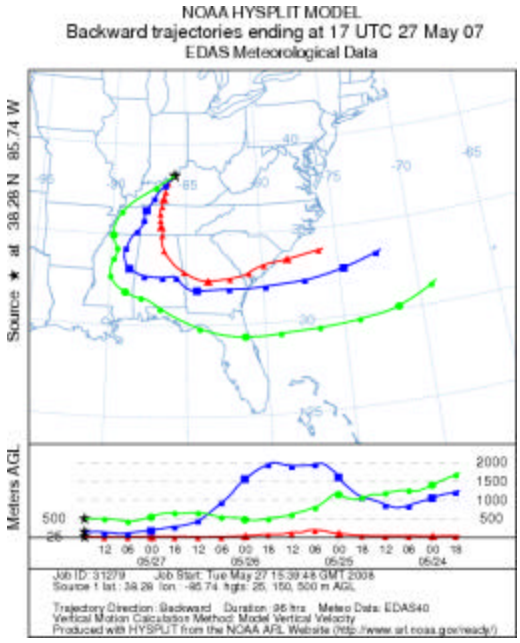


Figure 12.16: Backward trajectories originating from Jeffersonville on 5/27/07 at 12:00 PM EST showing continuation of the air mass passing over southern Georgia and northern Florida.

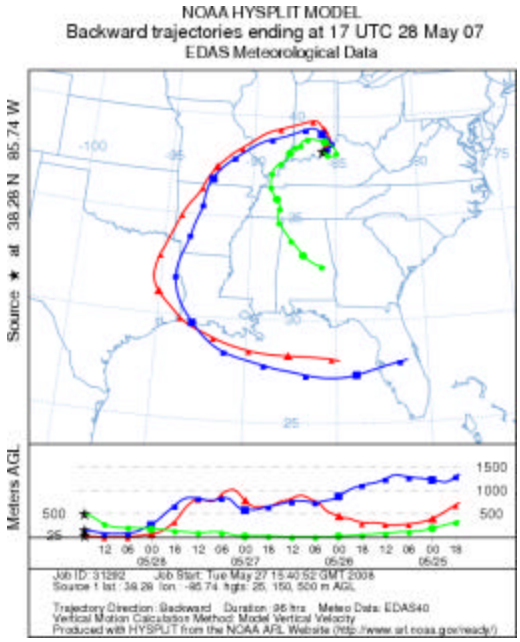


Figure 12.17: Backward trajectories originating from Jeffersonville on 5/28/07 at 12:00 PM EST showing continuation of the air mass passing over central Florida.

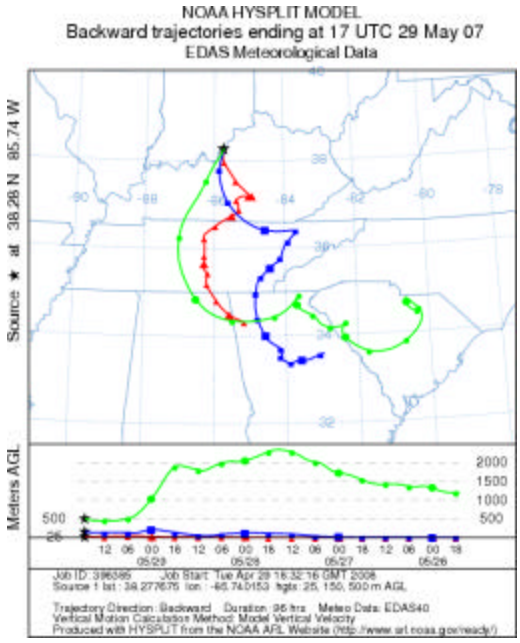


Figure 12.18: Backward trajectories originating from Jeffersonville on 5/29/07 at 12:00 PM EST showing the air mass continuing to originate from Georgia.

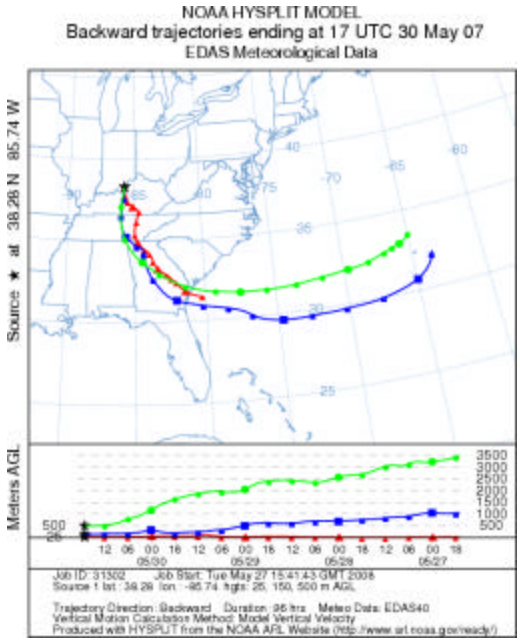


Figure 12.19: Backward trajectories originating from Jeffersonville on 5/30/07 at 12:00 PM EST showing consistency in the air mass passing over southern Georgia and northern Florida.

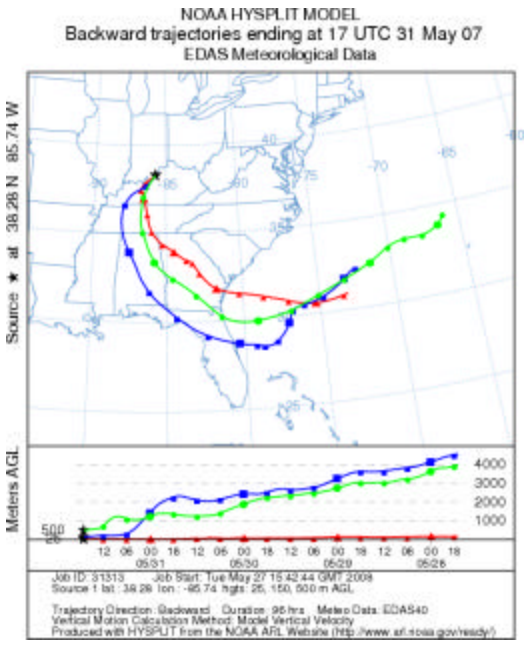


Figure 12.20: Backward trajectories originating from Jeffersonville on 5/31/07 at 12:00 PM EST showing consistency in the air mass passing over southern Georgia and northern Florida.

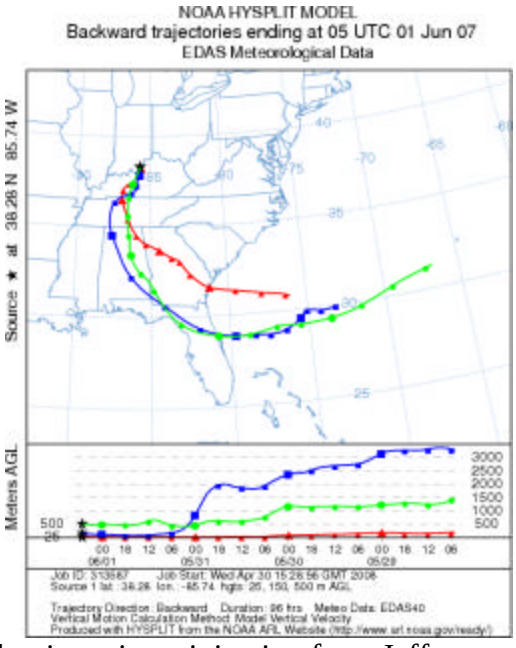


Figure 12.21: Backward trajectories originating from Jeffersonville on 06/01/07 at 12:00 AM EST showing the air mass still passing over southern Georgia and northern Florida.

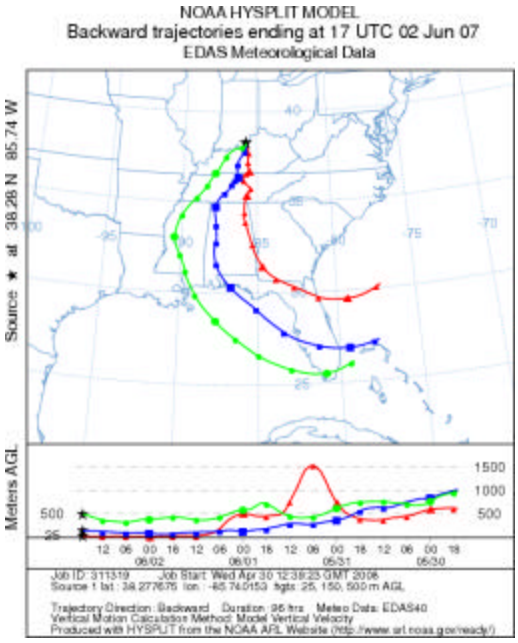


Figure 12.22: Backward trajectories originating from Jeffersonville on 6/02/07 at 12:00 PM EST showing continuation of the air mass passing over Florida.